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Our Reference: 9351-95

PRELIMINARY AMENDMENT

The Commissioner of Patents
and Trademarks
Washington, D.C.
20231, U.S.A.

Dear Sir:

Re: New United States Divisional Patent Application
Divisional of United States Patent Application No. 09/628,929
For: METHOD AND APPARATUS FOR HUMIDIFICATION AND
TEMPERATURE CONTROL OF INCOMING FUEL CELL PROCESS GAS
Inventors: Cargnelli et al

We are simultaneously filing herewith a divisional application of United States Patent Application Serial No. 09/628,929 filed on July 28, 2000. Please enter the following amendment in the divisional application.

In the Title:

Please delete "METHOD AND".

In the Specification:

Please insert the following paragraph on page 1, line 4 as follows:

-- The present application is a divisional of USSN 09/628,929 that was filed on July 28, 2000 (now pending).—

In the Drawings:

Formal drawings for the application are attached.

In the Claims:

Please delete claims 1-9 currently of record leaving claims 10-18 pending in the divisional application as claims 1-9 as follows..

1. An apparatus for humidifying a process gas stream, for a fuel cell, the apparatus comprising:
 - a humidification unit having an inlet for the process gas stream, for adding humidity to the process gas stream at a first temperature, to a humidity well in excess of a required humidity level;
 - a first heat exchanger connected to the humidification unit, for cooling the process gas stream to a second, lower temperature, whereby excess moisture in the process gas stream condenses, and for removing the condensed moisture, whereby the process gas stream leaving the heat exchanger has a known temperature and a known humidity level.
2. An apparatus as claimed in claim 1, which includes a first heater connected to the first heat exchanger, for heating the process gas stream to a third temperature, greater than the second temperature, whereby the process gas stream has a known absolute humidity level.
3. An apparatus as claimed in claim 2, wherein the humidification unit includes a steam injector for injecting steam into the process gas stream.
4. An apparatus as claimed in claim 2, which includes an outlet line connected to the first heater and an elongate heating means provided for the outlet line, for maintaining the outlet line at the third temperature.
5. An apparatus as claimed in claim 4, where the elongate heating means comprises elongate electrical heating elements.
6. An apparatus as claimed in claim 2, which includes a separator, for removing the condensed moisture, provided between the first heat exchanger and the first heater.
7. An apparatus as claimed in claim 2, wherein the first heat exchanger includes a first temperature control circuit, for controlling the temperature of the heat exchanger, the first temperature control circuit comprising a conduit for a fluid, a pump for pumping the fluid, and means for cooling the fluid.
8. An apparatus as claimed in claim 7, wherein the first cooling circuit additionally includes a further heater for heating the fluid.
9. An apparatus as claimed in claim 2 or 7, wherein the first heater comprises a second heat exchanger, and wherein the second heat exchanger is provided with a second temperature control circuit for controlling the temperature of the second heat exchanger, the second temperature control circuit comprising a conduit for fluid, a pump for circulating the fluid and a third heater for heating the fluid.

Please calculate the claim fee after the present amendment is entered.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "version with markings to show changes made".

Entry of the above preliminary amendment is respectfully requested.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Title:

The words "METHOD AND" have been deleted from the title.

In the Specification:

The following paragraph has been entered at page 1, line 4:

The present application is a divisional of USSN 09/628,929 that was filed on July 28, 2000 (now pending).

In the Claims:

Claims 1-9 have been deleted. Claims 10-18 are now pending in the divisional application as claims 1-9, as follows:

1. ~~A method of humidifying a process gas stream, the method comprising;~~
~~(a) humidifying the process gas stream at a first temperature so as to provide the process gas stream with excess humidity;~~
~~(b) cooling the process gas stream at a second temperature, lower than the first temperature, to cause condensation of excess moisture;~~
~~(c) removing excess condensed moisture from the process gas stream; and~~
~~(d) delivering the process gas stream at a known temperature, whereby the absolute humidity level in the process gas stream is determined from the maximum relative humidity at the second temperature.~~
2. ~~A method as claimed in claim 1, wherein step (d) includes heating the process gas stream to a third temperature greater than the second temperature.~~
3. ~~A method as claimed in claim 2, which includes humidifying the process gas stream in step (a) by injecting steam into the process gas stream.~~
4. ~~A method as claimed in claim 3, which includes injecting steam into the gas stream in an amount sufficient to supersaturate the process gas stream.~~
5. ~~A method as claimed in claim 2, which further comprises the step of supplying the humidified process gas stream at the third temperature to a fuel cell, and maintaining the third temperature of the process gas stream from step (d) at the third temperature, until the process gas stream reaches the inlet of a fuel cell.~~

6. ~~A method as claimed in claim 5, which includes maintaining the third temperature of the process gas stream, by delivering the process gas stream through a supply line, and providing a heating element extending along the supply line.~~

7. ~~A method as claimed in claim 2, wherein the first temperature is in the range 10 °C to 120 °C.~~

8. ~~A method as claimed in claim 7, wherein the second temperature is in the range 5 °C to 115 °C.~~

9. ~~A method as claimed in claim 8, wherein the third temperature is in the range 10 °C to 120 °C, and wherein the relative humidity of the process gas stream at the third temperature is in the range of 0 to _____ 100%.~~

40.1. An apparatus for humidifying a process gas stream, for a fuel cell, the apparatus comprising:

a humidification unit having an inlet for the process gas stream, for adding humidity to the process gas stream at a first temperature, to a humidity well in excess of a required humidity level;

a first heat exchanger connected to the humidification unit, for cooling the process gas stream to a second, lower temperature, whereby excess moisture in the process gas stream condenses, and for removing the condensed moisture, whereby the process gas stream leaving the heat exchanger has a known temperature and a known humidity level.

41.2. An apparatus as claimed in claim 401, which includes a first heater connected to the first heat exchanger, for heating the process gas stream to a third temperature, greater than the second temperature, whereby the process gas stream has a known absolute humidity level.

423. An apparatus as claimed in claim 442, wherein the humidification unit includes a steam injector for injecting steam into the process gas stream.

43.4. An apparatus as claimed in claim 442, which includes an outlet line connected to the first heater and an elongate heating means provided for the outlet line, for maintaining the outlet line at the third temperature.

44.5. An apparatus as claimed in claim 434, where the elongate heating means comprises elongate electrical heating elements.

45.6. An apparatus as claimed in claim 442, which includes a separator, for removing the condensed moisture, provided between the first heat exchanger and the first heater.

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46.7. An apparatus as claimed in claim 442, wherein the first heat exchanger includes a first temperature control circuit, for controlling the temperature of the heat exchanger, the first temperature control circuit comprising a conduit for a fluid, a pump for pumping the fluid, and means for cooling the fluid.

47.8. An apparatus as claimed in claim 467, wherein the first cooling circuit additionally includes a further heater for heating the fluid.

48.9. An apparatus as claimed in claim 44 2 or 467, wherein the first heater comprises a second heat exchanger, and wherein the second heat exchanger is provided with a second temperature control circuit for controlling the temperature of the second heat exchanger, the second temperature control circuit comprising a conduit for fluid, a pump for circulating the fluid and a third heater for heating the fluid.

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